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CALGON CORPORATION
PITTSBURGH, PA.

FOR

CCS
STANDARD PLANT

CCS TREATMENT PLANT

SPECIFICATION NO. 7209A-ES1
FOR
ELECTRICAL INSTALLATION
AND MATERIALS

April 19, 1973

REVISIONS

This specification has been revised as indicated below and the new pages added and/or the existing pages revised are attached as replacement for those previously issued.

<u>REV.</u>	<u>DATE</u>	<u>BY</u>	<u>PAGE</u>	<u>REMARKS</u>
0	4-24-73	RLB	ALL	Issued for Purchase and Construction
1	5-14-75	ABC	2, 4, 9, 10	General Revision and Reissue for Construction
2	10-7-75	ABC	3, 4, 10-11	Revised Grounding and Reissued for Construction
3	4-26-78	ABC	10, 11	Revised Equipment Designation Nameplate and Reissued for Construction
4	12-13-79	WAB	1	Title Update

ES1.1-11

1.0 SCOPE OF WORK

- 1.1 This specification covers information applicable to materials and installation requirements for the electrical systems to be furnished for the Calgon Adsorption System installations.

2.0 CODES AND STANDARDS

- 2.1 References to standards of organizations are made herein and on the drawings in accordance with the following abbreviations:

ANSI - American National Standards Institute
ASTM - American Society for Testing and Materials
FIA/FM - Factory Insurance Association or Factory Mutual
IEEE - Institute of Electrical and Electronics Engineers
IPCEA - Insulated Power Cable Engineers Association
NEC - National Electrical Code
NEMA - National Electrical Manufacturers Association
NFPA - National Fire Protection Association
OSHA - Occupational Safety and Health Act of 1970
UL - Underwriters' Laboratories, Inc.

3.0 PRODUCTS AND MATERIALS

3.1 GENERAL

- 3.1.1 Manufacturer's products specified are descriptive of type and quality required. Products of other reputable manufacturers of the same type and quality may be substituted.
- 3.1.2 Materials and equipment shall be new and shall be standard products of manufacturers regularly engaged in the production of such materials and/or equipment and shall be of the Manufacturer's latest designs. Materials not covered by detailed specifications shall be standard products of reputable manufacturers and their selection shall be submitted for approval by Calgon. All materials and equipment of a particular kind or type shall be products of the same Manufacturer.

3.2 METALLIC CONDUIT

- 3.2.1 Conduit shall be rigid, standard weight mild steel, hot dipped galvanized or sheradized.

3.3 FLEXIBLE METALLIC CONDUIT

- 3.3.1 Where limited flexibility is required such as at motor terminals, instrument connections, etc., flexible metallic conduit, "Sealtite" Type UA, as manufactured by American Brass Co., shall be used.

3.0 PRODUCTS AND MATERIALS (Cont'd)

3.4 CONDUIT FITTINGS AND ACCESSORIES

- 3.4.1 General: Fittings for rigid steel conduit shall be cast ferrous material with full threaded hubs and corrosion resistant metallic coating. Mogul type shall be used for 1-1/2" and larger sizes.

3.5 BOXES - OUTLET AND SWITCH, PULL AND JUNCTION TYPES

- 3.5.1 General Locations: Boxes and covers shall be steel and shall have sizes proportioned to conduit or conductors served. They shall be protectively coated inside and outside with a metallic conductive material such as tin, cadmium or zinc.
- 3.5.2 Wet Locations: Same as for General Locations except conduit entrances shall be threaded; rubber, neoprene, or similar gaskets shall be provided between box and cover; construction shall be rain-tight; boxes may be of cast iron.

3.6 STARTERS, SWITCHES AND WIRING DEVICES

- 3.6.1 Starters will be furnished by others.
- 3.6.2 Convenience outlets for 110 volt general purpose use shall be duplex, 15 ampere, 125 volt, 3 wire grounding type, Hubbell No. 5262, in box as shown on drawings.
- 3.6.3 All convenience outlet plates in general purpose areas shall be .040 Stainless Steel Chrome-X Plates and shall suit type of outlets installed.

3.7 LIGHTING FIXTURES

- 3.7.1 Specifications for lighting fixtures are given in the notes on the electrical drawings.

3.8 CONDUCTORS

- 3.8.1 All wire size #8 and larger shall be stranded.
- 3.8.2 Wires and cables 600 volt and below shall be Type TW with 902 Synthol insulation unless otherwise noted on drawings.

3.9 GROUNDING MATERIAL

- 3.9.1 Grounding Conductors: Bare, soft drawn or medium hard drawn copper wire, strap, or as called for on drawings. Sizes #4 and smaller shall be solid, and sizes #2 and larger shall be stranded. Sizes smaller than #6 shall not be used for buried grounding conductors.

3.0 PRODUCTS AND MATERIALS

3.9 GROUNDING MATERIAL (Cont'd)

3.9.2 Ground Rods and Accessories: Make, type, sizes and materials to be as called for on the drawings.

3.10 PIPE TRACING MATERIAL

3.10.1 Heat tracing system shall be as manufactured by Chemelex, a Division of Raychem Corporation, 837 Second Avenue, Redwood City, California 94063, Electro-Trace Corporation, #2 Industrial Plaza Road, Danbury, Connecticut 06810, or approved equal.

3.10.2 Tape 3-1/2 inches wide shall be Teflon insulated type with 24 watts per foot rating.

3.10.3 Tape 1-3/8 inches wide shall be Teflon insulated type with 6.5 watts per foot rating.

3.10.4 Thermostats shall be line voltage, Robertshaw model CT-71-1001, or equal, with 30° - 230°F range, in NEMA 4 enclosure, nickel plated copper bulb with 10 ft. capillary, and 20 amp capacity.

3.10.5 Bridging shall be stainless steel strips same width as heating strip.

4.0 INSTALLATION

4.1 GENERAL

- 4.1.1 The Contractor shall be responsible for the accurate detail layout of his work so that it will function as intended.
- 4.1.2 Field dimensions shall be checked and verified by the Contractor prior to installation to assure proper fit of all components.
- 4.1.3 The installation shall comply with all applicable State and/or local codes applying to electrical installations in effect as of date of this contract; with the regulations of the National Electrical Code and the National Electrical Safety Code where such regulations do not conflict with laws currently in effect; with the regulations of the Utility Company or Utility Authority furnishing electrical service; and with all OSHA regulations.
- 4.1.4 All work will be subject to field inspection by Calgon. After completion of the work the Contractor shall furnish to Calgon a certificate of final inspection and approval from the electrical inspection agency having jurisdiction.
- 4.1.5 When a part of the electrical system is placed into service by Calgon prior to the date of final approval, that particular system or equipment shall then commence its one year period of guarantee. This guarantee shall expire one year after such system or equipment is placed in service without regard to the date when the final certificate of approval covering the entire system is granted.

4.2 CONDUIT

- 4.2.1 In no case shall any duct be formed, or any conduit be bent, or any fabricated elbow be applied to less than the allowable bending radius of the conductor to be installed.
- 4.2.2 Separation of not less than 6" shall be maintained between all conduits and the insulation of hot water lines, steam lines or any other work liberating heat in excess of conductor rating. When this separation cannot be maintained, a pipe covering shall be used, applied on the conduit and subject to the approval of Calgon.
- 4.2.3 The exact locations and routing of conduit, when not shown in detail on drawings, shall be determined by the Electrical Contractor subject to approval by Calgon.

4.0 INSTALLATION

4.2 CONDUIT (Cont'd)

4.2.4 When necessary to make field bends, they shall be made with tools designed for conduit bending. Heating of conduit to facilitate bending will not be permitted.

4.2.5 End of conduit runs shall be protected immediately after installation by steel bushings and flat non-corroding metallic discs. Discs shall not be removed until necessary in order to pull the wire. Contractor shall be responsible for the entrance of foreign matter into the conduit system and shall make repairs or replacements if necessary at no extra expense to Calgon.

4.2.6 Motors on vibrating mountings shall be connected to the rigid conduit system as shown on the drawings with flexible metallic conduit to permit maximum expected movement.

4.2.7 Location of Supports for Conduit:

<u>Conduit Size</u> <u>Inches</u>	<u>Location</u>	<u>Max. Spacing</u> <u>of Supports</u> <u>Feet</u>
<u>Horizontal Runs</u>		
1/2 & 3/4	Any Location	6
1 & Larger	Any Location	8
<u>Vertical Runs</u>		
1/2 & 3/4	Exposed	7
1 & 1-1/4	Exposed	8
1-1/2 & Larger	Exposed	10

4.2.8 Pull boxes shall be installed to sectionalize runs of conduit where the number of 90 degree bends exceeds the following:

<u>Max. Length of Run</u> <u>Feet</u>	<u>Max. No. of 90° Bends</u>
0-49	4
50-99	3
100-149	2
150-199	1

4.2.9 Exposed conduit shall be run at right angles to or parallel to building structural members wherever possible and shall be adequately supported by brackets, clamps, or braces wherever required. Diagonal runs shall not be made except in special cases or in concealed work, and must be approved by Calgon.

4.0 INSTALLATION

4.2 CONDUIT (Cont'd)

- 4.2.10 Conduits shall be rigidly supported with one hole malleable iron conduit clamps, Unistrut Corp. supports, or C. C. Korn Company's clamps, depending on the type of construction or as indicated. Where a group of conduits run together, support on hangers fabricated from light steel framing, Unistrut, or as indicated.
- 4.2.11 Perforated flat steel strap shall not be used for supporting conduit.
- 4.2.12 Conduit shall be installed in such a manner that wires may be removed and replaced at a later date.
- 4.2.13 Conduit shall be continuous from outlet to outlet and from outlet to cabinets, junction boxes and/or pull boxes, and shall enter and be secured in such a manner that each system shall be electrically continuous from a point of service to all outlets.
- 4.2.14 When local interferences require changes in the location of outlets from those shown on drawings, such changes may be made only if approved by Calgon.
- 4.2.15 Where there is a probability that water or other condensed vapor may be trapped within housings or enclosures or at any point in the conduit system, UL approved drains shall be provided at low points to prevent accumulation or to permit periodic draining of water or condensed vapor. Where provisions have been made in enclosures or housings for breathers such breathers shall be provided and installed.
- 4.2.16 Installation of seals and drains shall be such as to permit access and inspection.

4.3 INSULATED CONDUCTORS

- 4.3.1 Bending radius of any insulated cable or conductor, either permanent or temporary, shall not be less than the minimum recommended by the Manufacturer.
- 4.3.2 To facilitate pulling of cables in ducts, Electro-Compound Co. "Yer-Ease", Ivory Soap Flakes, or powdered soapstone only may be used.
- 4.3.3 Attachments for pulling cable shall be patented cable grips, or other devices subject to Calgon's approval. In using woven basket grips on lead-covered cable, care shall be taken to avoid damage to the cable-end seal, which shall be maintained during cable installation.

4.0 INSTALLATION

4.3 INSULATED CONDUCTORS (Cont'd)

- 4.3.4 Maximum pull tension for any conductor or cable shall not exceed Manufacturer's recommended value when measured by tension dynamometer.
- 4.3.5 After being pulled in, each cable or conductor shall be identified at both terminations and in intermediate manholes, handholes, junction boxes and pull boxes by attachment of suitable plastic or non-ferrous metal discs or markers, stamped with the circuit designation shown on the drawings.
- 4.3.6 In terminal boxes, panelboards, switch boards, or any termination in close proximity to energized parts, identifying discs or markers shall be plastic or fiber attached to cable with strong twine.
- 4.3.7 Connections to insulated leads, current transformers or busses shall be covered and taped in a manner appropriate to the class of insulation originally on the conductor. Irregular connectors and surfaces shall be plastered smooth with Johns-Manville Dux-Seal, or equal, before taping. All terminal taping shall be painted with General Electric Co., Glyptol No. 1201.
- 4.3.8 Connection of conductors of #6 AWG and larger, to panels and apparatus shall be by means of approved lugs or connectors. Cast copper lugs shall be used on all feeder cables.

4.4 SHIELDED CONDUCTORS

- 4.4.1 Shielded cable supplied by Calgon shall be installed in accordance with the Contract Drawings.
- 4.4.2 Contractor shall not cut this cable. Excess length shall be coiled neatly in the Control Panel.

4.5 INSTRUMENTS, CONTROLS AND PANELS

- 4.5.1 Electrical instrument items have been procured by Calgon. These shall be installed by the Electrical Contractor in accordance with the Contract Drawings and the Manufacturer's written instructions.

4.6 LIGHTING SYSTEMS

- 4.6.1 Fixtures shall be installed accurately as to line and level. Fastenings and supports shall be firmly set so that fixtures will not be distorted by handling incident to normal maintenance.

4.0 INSTALLATION

4.6 LIGHTING SYSTEMS (Cont'd)

- 4.6.2 Fixture wire shall not be less than #12 AWG.
- 4.6.3 Convenience outlets shall be mounted at 1'-6" from the floor, unless noted otherwise on the drawings.
- 4.6.4 At the time of final inspection, all fixtures and equipment must be complete with the required glassware and/or reflectors which must be clean and free of defects. Any glassware or reflectors broken prior to the time of final acceptance must be replaced.
- 4.6.5 Contractor shall properly label the circuits he installs on the directory provided in the lighting panel.

4.7 MOTOR OVERLOADS

- 4.7.1 The Contractor shall check the overload relay heaters furnished with the starters. These shall be checked with the full load current as shown on each motor nameplate and with the overload relay heater selection tables in the catalog of the Manufacturer of each starter supplied. If any overload relay heater as supplied with a starter is rated incorrectly, the Contractor shall replace it with one of the size and make as required by the Manufacturer of the starter.

4.8 GROUNDING

- 4.8.1 All conduits, cabinets, panels, secondary neutrals and other exposed non-current carrying metal parts of electrical equipment shall be grounded.
- 4.8.2 All contact surfaces shall be thoroughly clean and bright, before connections are made, to insure good electrical contact.
- 4.8.3 All grounding connections shall be made by the "Cadweld" process or by mechanical type connectors; bolts and nuts shall be of silicon bronze material and shall be secured by lock washer or equivalent.

4.9 HEAT TRACING

- 4.9.1 All pipe tracing material shall be installed in accordance with the Manufacturer's published recommendations.
- 4.9.2 All flanges and fittings shall be jumpered or bridged.
- 4.9.3 All vessel tracing shall be installed in accordance with the contract drawings.

4.0 INSTALLATION (Cont'd)

4.10 SUPPORTS

4.10.1 Steel supports, rod supports, hangers, etc., for starters, transformers, control devices and other such equipment shall be furnished and installed by the Electrical Contractor. If supports for these have not been detailed, they shall be designed and fabricated by the Electrical Contractor subject to approval by Calgon.

4.11 EQUIPMENT IDENTIFICATION

4.11.1 Motor starters, disconnecting switches and other similar equipment having important functions in process or safety requirements, shall be identified in a clear, legible and durable manner. Stenciling or skilled free-hand painting may be employed if approved by Calgon. Color of the imprint shall have a suitable contrast to the applied field.

5.0 TESTING

- 5.1 All Tests shall be performed in the presence of the Calgon Engineer. Electrical Contractor shall furnish all instruments and personnel required for the tests. The Owner will furnish necessary electric power.
- 5.2 Insulation Resistance Test shall be made in accordance with applicable provisions of NEC after all wiring and connections are completed.
- 5.3 Operation Test: Equipment shall be energized and full load shall be carried for a minimum of 2 hours, unless otherwise required by Calgon. Equipment shall be checked at this time for proper starting, rotation, heating, undue vibration, noises, etc.
- 5.4 Grounding Tests for the grounding system shall be made in accordance with one of the following methods and the combined resistance of the grounding conductor and the connection with ground shall not exceed 5 ohms for artificial (driven) grounds. If the 5 ohm or better resistance is not achieved, additional ground rods shall be driven in order to provide the required resistance before backfilling the grounding system. In cases of grounding to water pipes, the combined resistance of the grounding conductor and the connection with ground shall not exceed 3 ohms.
- a. Three Point Method: using an ammeter and voltmeter with alternating current or direct current power supply.

5.0 TESTING

5.4 (Cont'd)

- b. Commercial Instrument Method: using "Megger" ground tester as manufactured by James G. Biddle Company, Philadelphia, Pennsylvania, or "Vibraground" tester manufactured by Associated Research, Inc., Chicago, Illinois.

6.0 COOPERATION WITH OTHER CONTRACTORS

- 6.1 The Equipment Installation Contractor is responsible for receiving, unloading and setting into position all mechanical equipment and control panels. Electrical Contractor shall cooperate with him to assure that all electrical equipment is properly protected and installed.
- 6.2 The Piping Installation Contractor is responsible for receiving, unloading and setting into position all "in-line" control devices and control valves. Electrical Contractor shall install electrical interconnections as shown on the drawings.